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Roof bolter.

A roof bolter (10) comprising combined means (22) for drilling and resin bolting with the roof bolter in one operative position, means (24) for bolt inserting with the roof bolter in a second operative position, and means (26) for positioning the roof bolter first into this one and then into its second operative positions.

The invention also provides a device designed for attachment to a three-position resin type roof bolter and converting it to a two-position resin type roof bolter.

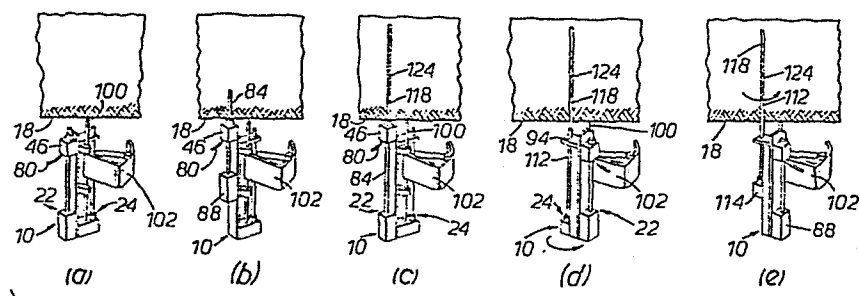


FIG. 6.

ROOF BOLTER

1 This invention relates generally to roof bolters
and, more particularly, to a two-position roof bolter
and process for resin bolting a mine roof.

5 Underground mining, whether for coal or ore, is an
old art. There are two principal methods of underground
mining: room-and-pillar and longwall working. Room-and-
pillar mining denotes a system of mining in which the
coal or ore is mined in rooms (i.e., tunnels) separated
by pillars. Room-and-pillar mining is preferred when
10 mining beneath surface building or under lakes and seas.
The pillars are preferably left in position to minimise
movement of the ground at the surface. When the pillars
are left in place, the term "partial extraction" is
applied to this system of mining. In room-and-pillar
15 mining, once access to the seam has been gained, rooms
(i.e., tunnels) are driven into the seam in two directions
and at right angles to each other. As a result, the seam
is divided into a number of rectangular blocks of coal
or ore, which rectangular blocks are called pillars. In
20 contrast, longwall working is a "total extraction" system
of mining. In longwall working, all the coal or ore
contained within a specified area is extracted in one
operation. To do this, two parallel tunnels (also known
as gate roads) are driven into the seam some 150 to 600
25 feet apart. The two parallel tunnels are then connected
by a third tunnel formed at right angles to the two para-
llel tunnels. This third tunnel forms the longwall face.
Successive strips are then taken off the side of the long-
wall face and the coal (or ore) is deposited on a face
30 conveyor. The face conveyor in turn delivers the coal to
the gate road conveyor and hence to the shaft. As the
longwall face moves forward, the roof behind the face is
allowed to collapse. The gate roads (the tunnels)
however are being correspondingly advanced and of course
35 supported. It is to the support of these tunnels, be
they gate roads or rooms, that the invention pertains.

1 For the drilling of the tunnels themselves, see United
States Patent No. 3,552,504 (L.L. Chappuis).

5 One of the more effective ways to support the
tunnels is by inserting roof bolts in predrilled holes in
the roofs of the tunnels. (A roof bolt is a long steel
bolt anchored into walls or roofs of underground excava-
tions to strengthen the pinning of rock strata.) The
roof bolts are installed into the roofs at substantially
evenly spaced intervals. The distance separating the
10 bolts can vary from about 60 cm. to about 120 cm.,
depending upon the degree of support required. Basically,
there are two kinds of roof bolts, depending on how the
bolts are anchored in the roof: a mechanically anchored
roof bolt and a resin-anchored roof bolt. The mechani-
15 cally anchored roof bolt is point anchored in the roof by
the physical interaction between the expandable point
anchor and the rock surrounding the anchor. This is fine
until there is movement in the rock formation surrounding
the bolt. If such movement in the rock surrounding the
20 bolt is extensive, the bolt may give and weaken its
support. In tunnels where long term support is required,
resin-anchored bolts are preferred. The resin-anchored
bolt is anchored in the resin introduced into the bolt
hole ahead of the bolt. The resin, once set, forms a
25 hard, solid, chemically formed bond with the rock forma-
tion surrounding the bolt and along the entire length of
the bolt. Such a resin anchor is considerably stronger
and longer lasting than merely mechanically anchored roof
bolts.

30 Automated and remote controlled machines have been
developed to perform roof bolting operations in mines.
These roof bolting machines are very expensive. They are
expensive because they have to be both efficient and safe
deep down in a mine. Due to these requirements, these
35 machines have become rather complex.

A roofbolting operation essentially entails drilling
a long, narrow, vertical hole into the mine roof and
inserting and anchoring a bolt in the hole. For the

1 mechanically anchored roof bolt, these two steps only
are required. For the resin-anchored roof bolt a third,
intermediate step - resin insertion - is also required.
Roof bolting machines feature two-position turrets for
5 roofbolting with mechanically anchored roof bolts, and
they feature three-position turrets for roofbolting with
resin-anchored roof bolts. If resin bolting is desired
with only a two-position turret available, the resin then
must be inserted into the drilled hole by some means other
10 than by the turret. Often, this involves manual inser-
tion. Manual insertion exposes the operator to risk,
however. Representative three-position roof bolter
apparatus are disclosed in United States Patent Nos.
4,215,953 and 4,229,124 (R.J. Perraud and G.R. Frey et al,
15 respectively).

The three-position turret is, on the other hand, a
rather complex and expensive piece of equipment. For,
in addition to providing a separate means for inserting
the resin into the drilled hole, it requires other feat-
20 ures in support of this resin insertion operation. These
additional features include a reaming bit and a reaming
motor, together with associated components. These are
needed to drill a cone-shaped collar around the entrance
of the hole. Such a cone-shaped collar is necessary to
25 guide the resin injection nozzle into position with
respect to the hole see United States Patent No. 5,105,081
(R.J. Perraud). The presence of these additional features
on the turret, in turn, requires further and more compli-
cated accessories in the automated remote control system
30 for the turret. All this has a mushrooming effect,
especially as regards costs - both initial costs of manu-
facture and, perhaps more significantly, operational and
maintenance costs of such roofbolting equipment.

According to one aspect of the present invention,
35 there is provided a two-position resin type roof bolter
with a single indexing between said two positions compri-
sing:

- 1 (a) combined means for drilling and resin inserting
in one position of said roof bolter without
indexing between said drilling and said resin
inserting;
- 5 (b) means for bolt inserting in a second position
of said roof bolter after said single indexing
thereof; and
- (c) means for positioning said roof bolter, first
into said one and then into its said second
10 position.

Preferably, the roof bolter is automated and remotely
controlled.

According to another aspect of the present invention,
there is provided a process for resin bolting a mine roof
15 comprising:

- (a) positioning a turret into a drilling position
with respect to said mine roof;
- (b) drilling a hole with said turret in said mine
roof;
- 20 (c) without re-positioning said turret, inserting a
resin cartridge with said turret into said hole;
and
- (d) positioning said turret into a bolt inserting
position with respect to said hole and insert-
25 ing a bolt with said turret into said hole.

A further feature of the invention provides a device
designed for attachment to a three-position resin type
roof bolter and for converting the same to a two-position
resin type roof bolter.

30 For a better understanding of the invention and to
show how the same may be carried into effect, reference
will now be made, by way of example, to the accompanying
drawings, in which:-

FIGURE 1 is a side view of a resin type roof bolter
35 shown attached to a boom on a carrier;

FIGURE 2 is a plan view of the roof bolter of FIG. 1;

FIGURE 3 is a side view of the roof bolter of FIG. 1
in action in a mine tunnel;

1 FIGURE 4 is a perspective view of the roof bolter
and the boom of FIG. 1, illustrating the several
possible motions of each;

5 FIGURE 5 is a perspective view of the roof bolter
attached to the boom, also showing a magazine holding
additional roof bolts;

 FIGURE 6 (a) - (e) depict the roof bolter in action;

 FIGURE 7 shows a roof bolter, with parts omitted
for clarity, in the drilling mode;

10 FIGURE 8 is a side view, on an enlarged scale, of
a device, designed for converting a three-position resin
type roof bolter to a two-position resin type roof bolter,
and taken along the lines 8-8 of FIG. 7;

15 FIGURE 9 is a view similar to that of FIG. 7 but
showing the roof bolter in the resin injection mode;

 FIGURE 10 is a view similar to that of FIG. 8 but
showing the device in the resin injection mode and taken
along the line 10-10 of FIG. 9;

20 FIGURE 11 is a view similar to that of FIG. 8 but
showing a different embodiment of a device for convert-
ing a three-position resin type roof bolter to a two-
position type roof bolter;

 FIGURE 12 is a front view of the device of FIG. 11;

25 FIGURE 13 is a plan view of the device of FIG. 11;
and

 FIGURES 14 and 15 are perspective views of removable
component parts of the device of FIG. 11.

30 Generally, the illustrated embodiment of a resin
type roof bolter 10 is shown in Figure 1 mounted on a
bolter boom 12 of a carrier 14. The carrier 14 is comp-
pletely self-contained and highly manoeuvrable. The
carrier 14 has been designed to enter a freshly mined
tunnel 16 whose roof 18 is intended to be reinforced by
roofbolting; observe Figure 3. The construction of the
35 boom 12 and of the thereon mounted roof bolter 10 are such
(note Figure 4) that the roof bolter 10 can be made to
operate on any exposed surface of the mine tunnel 16,

1 not just the roof 18 thereof. The arrows shown in Figure
4 indicate the several motions that each is capable of,
whereby the roof bolter 10 can be aimed at any desired
site within the tunnel.

5 Preferably, the carrier 14 is powered by a diesel
engine 20. The diesel engine 20 in turn drives both a
tramming hydraulic motor and a group of hydraulic pumps.
The hydraulic motor provides the tramming to the carrier
14, and the group of hydraulic pumps respectively actu-
10 ate the boom 12, the roof bolter 10 and the various
operative parts of the roof bolter 10, as more fully
described hereinafter.

The resin type roof bolter 10 (also known as a
turret) essentially comprises combined means 22 for drill-
15 ling and resin inserting in one position, means 24 for
bolt inserting in another position, and means 26 for
positioning the roof bolter 10, first into one and next
into its second operative positions. The combined means
22 for drilling and resin inserting includes a device
20 28 having converging passages 30 and 32. One passage 30
is designed for drilling and the other passage 32 is
designed for resin inserting. The device 28 comprises
a housing block 34 preferably formed with an integral neck
portion 36 and with angularly faced lower ends 38 and 40.
25 The passage 30 is formed concentric with the neck portion
36, extends through the block 34 and exits in between
the angularly faced lower ends 38 and 40. Passage 32
connects with the concentric passage 30 at an angle $42 - \alpha$
and below the neck portion 36. The angle $42 (\alpha)$ is
30 preferably about 30° . The housing block 34 can be provi-
ded further with a vent 44, whose significance will
become apparent from a discussion of the operation of the
roof bolter 10 to which it is attached.

A second preferred embodiment of a device 46 that
35 forms part of the combined means 22 for drilling and
resin inserting and employed for converting a three-posi-
tion resin type roof bolter to a two-position resin type

1 roof bolter is shown in Figures 11-14. Device 46 prefer-
ably comprises a housing block 48 and nozzles 50 and 51
mounted on the block 48. Preferably the nozzles 50 and
5 51 are formed with externally-threaded portions 52, 53
and hexagonal heads 54 and 55, respectively. The hous-
ing block 48 in turn is provided with tapped portions
56 and 57, meshing with portions 52, 53 of the nozzles
50 and 51. The threaded portions 52 and 53 preferably
are formed with directions opposed to the rotation of
10 the drilling means 22 lest the nozzles 50 and 51 work
themselves loose during drilling. Preferably, the
nozzles 50 and 51 are provided also with hard inner
bushings 58 and 59, preferably extending along their
axial lengths. The housing block 48 further is provided
15 with a ring member 60 concentrically surrounding the
nozzle 50. The ring member 60 is secured to the housing
block 48, such as, for instance, by being welded thereto
as at 62. In order to protect the nozzle 50 during
drilling, the ring member 60 preferably extends from the
20 housing block 48 a short distance beyond the nozzle 50.

The device 46, just like the device 28, is formed
with converging passages 64 and 66 connecting with each
other at an angle $68-\beta$ and below the nozzle 50. Prefer-
ably the angle 68 is also about 30° . The device 46 may
25 also be provided with a vent communicating with the
passage 64. The passage 64 is concentric with the
nozzle 50 and 51, extends through the housing block 48
and exits between angularly faced lower ends 72 and 74.
The inside diameter of the passage 64 is somewhat smaller
30 than the inside diameter of the hard, inner bushing 58.
The passage 66, furthermore, is formed with an internal
shoulder 76 and an enlarged portion 78 to facilitate the
attachment thereto of a resin injection tube 80, without
the need of a connecting member 82, as is the case with
35 the device 28; observe Figure 10.

The combined means 22 for drilling and resin inser-
ting further includes a drill member 84 carrying a drill
bit 86 at its front end. The drill member 84 is

1 secured at its other end within a drilling motor 88
mounted via a suitable bracket 90 on a feed 92. The feed
92 is, in turn, secured to a roof bolter housing 94. The
roof bolter housing 94 in turn is mounted via a pair of
5 brackets 96 and 98 to an anchoring pin 100. Preferably,
one roof bolter housing 94 is so mounted to the anchoring
pin 100 as to be axially displaceable about the pin 100.
The anchoring pin 100 is secured within a member 102,
which is mounted on the bolter boom 12. Preferably, the
10 drill member 84 is hollowed along its axial length for
water or air flushing with compressed air, as is known in
mine drilling operations. Also, preferably, the roof
bolter 10 is provided with means 104 for remote control
operation of the roof bolter 10. Such means 104 is
15 conveniently mounted on the carrier 14 within easy access
of an operator. The means 104 is connected via suitable
cables 106, carried by the boom 12, to the roof bolter 10.
Preferably, the remote control operation of the roof
bolter 10, as provided by the means 104, is automated.
20 Also, preferably, a bolt magazine 108 is provided adjacent
the member 102 and secured thereto. The bolt magazine
108 is designed to contain a plurality of additional bolts
110 (three being shown in FIG. 5) to provide the roof
bolter 10 with a capacity for continuous, automated
25 operation in roofbolting a larger segment of the mine
roof 18 than is possible without the magazine 108. Once
the magazine 108 is manually loaded with the additional
bolts 110, it has automatic feed means to advance the
bolts 110, seriatim, and to replace a further bolt 112
30 ready for insertion. This bolt 112 is, of course,
secured within the bolt inserting means 24 that includes
a wrench 114. The wrench 114 is designed both to rotate
the bolt 112 positioned therein and to advance the
rotating bolt 112 during bolt insertion. The bolt
35 inserting means 24 is secured to the roof bolter housing
94 at a position opposed to that of the combined means
22 for drilling and resin inserting, as may be best

1 observed in Figure 2.

Operation

5 The process for resin bolting the roof 18 of a mine tunnel 16 with the two-positioned roof bolter 10 of the invention is illustrated in Figures 6, 7 and 9. Figure 6 depicts the roof bolter 10 in action after the carrier 14 has been positioned into appropriate roofbolting position with respect to a segment of the roof 18 in the tunnel 16.

10 After loading the bolt magazine 108 with the bolts 110 and placing the bolt 112 into the wrench 114, the operator moves the roof bolter 10 into operative position with respect to the roof 18 by movements of the bolter boom 12. This he accomplishes by manipulating the controls
15 at the remote control means 104. When the operator is satisfied that the site selected in the roof 18 is the desired one for roofbolting, he causes the roof bolter 10 to be anchored in place against the roof 18 by firmly lodging the anchoring pin 100 thereagainst, as shown in
20 Figure 6(a). The anchoring pin 100 of the roof bolter 10 remains in this position during the entire roofbolting operation. The roof bolter housing 94 is still in its lowermost position away from the roof 18 and the roof bolter 10 is in its drilling and resin inserting first
25 operative position.

Just prior to drilling and resin inserting, the roof bolter housing 94 is caused to advance axially about the anchoring pin 100 towards the roof 18 until either the
30 neck portion 36 of the device 28 (Figure 7) or the ring member 60 of the device 46 (Figure 6(b)) (depending which device has been attached to the roof bolter 10) comes to rest against the roof 18. Now the roof bolter is ready to commence drilling a hole 116 (in Figure 7, or 118 in
35 Figure 6) in the mine roof 18. Drilling of the hole 116 (or 118) is accomplished by rotating the drill member 84 and axially advancing it through one 30 of the converging passages of the device 28 (or through the passage 64 in

1 the device 46), as may be best observed in Figure 8.
During drillings, water or air under pressure is contin-
uously admitted through the axial hollow of the drill
member 84 to the drill bit 86 for continuously flushing
5 the hole 116. A water and cuttings collector 120 (or
if air is used, simply a cuttings collector) is mounted
just below the combined means 22 for drilling and resin
inserting; observe Figure 5. A hose 122 connected to
the collector 120 drains the water and/or the cuttings
10 to the mine floor, protecting thereby the roof bolter 10
from extra unnecessary wear. A further hose (not shown)
can be connected to the vent 44 (Figures 8 and 9) to keep
the device 28 clean during drilling.

Upon completion of the drilling operation, the drill
15 member 84 is withdrawn from the just drilled hole 116 to
the position shown in Figure 10. As can be observed in
Figure 10, the drill bit 86 leaves vent 44 partially
uncovered. It should be noted, however, that the
combined means 22 for drilling and resin inserting,
20 including either the device 28 or the device 46, remains
in fixed position against the mine roof 18 after the
completion of the drilling operation and during the resin
insertion.

In resin bolting, the resin is typically introduced
25 into the hole 116 contained within an appropriately shaped,
flexible cartridge 124. The cartridge 124 is preferably
formed of a resilient, deformable material that is susce-
ptible to being broken. The cartridge 124 is designed to
be injected under pressure into the hole 116 via the
30 pneumatic tube 80. See United States Patent No. 4,215,953,
supra, for a resin cartridge injection device. Any excess
air under pressure is allowed to escape through the
partially uncovered vent 44. Since the device 28 (or the
device 46) has remained in a flexible place during both
35 the drilling and the resin inserting operations, the here-
tofore existing need for reaming a bevel at the entry of
the hole 116 has been eliminated. This cone-shaped bevel

1 is required with prior-art three-position roof bolters to
allow some degree of flexibility for a separate resin
injection nozzle to locate and become aligned with the
hole 116. For, in case of misalignment, the resin
5 cartridge 124 is apt to break at the entry to the hole
116. The spilled resin flowing from the ruptured
cartridge 124 not only makes roofbolting of that partic-
ular hole 116 unlikely but it renders further roofbolting
impossible until after the roof bolter has first been
10 thoroughly cleaned and the remnants of the spilled resin
removed therefrom. Thus, the roof bolter 10 of the
invention eliminates the need for a hydraulic reaming
motor to drive a reaming bit for reaming a bevel at the
entry of the hole 116. It also eliminates the need for a
15 separate resin injection nozzle and associated components
to introduce that nozzle into the hole 116.

Preferably, the resin cartridge 124 is injected
about two-thirds up into the drilled hole 116, observe
Figure 9 (or within hole 118 in Figure 6(c)). This
20 position for the cartridge 124 within the hole 116 is
advantageous for optimum bolt insertion and bolt setting
following pivoting the two-position roof bolter 10 into
its second operative position.

Following the injection of the resin cartridge 124
25 into the hole 116 (or hole 118 in Figure 6), the roof
bolter housing 94 is retracted axially about the anchoring
pin 100 away from contact with the mine roof 18, with only
the pin 100 remaining anchored against the roof 18. This
retraction for the housing 94 is required to enable the
30 roof bolter 10 to be pivoted into its second operative
position, namely that of bolt inserting, as shown in Figure
6(d). This pivoting of the roof bolter 10 is accomplished
by the positioning means 26 described particularly with
reference to Figures 1 and 2. Basically, this positioning
35 means 26 includes appropriate arms secured to the bolter
boom 12 and manipulated remotely by an operator via the
control means 104 mounted on the carrier 14. With the
bolt inserting means 24 in position following pivoting,

1 the bolt 112 is now ready for insertion into the hole 118.
Bolt insertion commences after the roof bolter 10 has
been once again advanced axially about the anchoring pin
100 until it comes to rest against the roof 18 of the
5 mine tunnel 16. Thereupon, the wrench 114 causes the bolt
112 both to revolve and to advance into the hole 118.
Preferably, the wrench 114 revolves at about 600 r.p.m.
during bolt insertion. When the bolt 112 reaches the
resin cartridge 124 previously injected into the hole
10 118, it ruptures the same. The still advancing and
rotating bolt 112 first thoroughly mixes the spilled
resin from the cartridge 124 along the axial length of
the bolt 112 during the time that the bolt 112
completes its full penetration of the hole 118. Once the
15 bolt 112 achieves its full penetration, its continued
revolution creates a temperature increase in the resin
within the hole 118 that allows for quick setting of
the resin about the now inserted bolt 112 almost immedia-
tely after its rotation by the wrench 114 ceases. Upon
20 the setting of the resin about the inserted bolt 112, the
wrench 114 is allowed to release the bolt 112.
Then, the roof bolter 10 first is axially retracted about
the anchoring pin 100 from its contacting position with
the mine roof 18. Second, the bolter boom 12 is caused
25 to lower away the roof bolter 10 from its anchored
position via the pin 100 against the roof 18. The process
cycle is now complete. The bolter boom 12 is now caused
to move the roof bolter 10 into a new roofbolting
position with respect to the roof 18 so as to commence
30 the next resin bolting operation. With three additional
bolts 110 in the bolt magazine 108, four bolts can be
installed in the roof 18 before a manual reloading of
the magazine 108 and of the roof bolter 10 is again
required.

1 CLAIMS:

1. A two-position resin type bolter with a single indexing between said two positions comprising:

- 5 (a) combined means for drilling and resin inserting in one position of said roof bolter without indexing between said drilling and said resin inserting;
- 10 (b) means for bolt inserting in a second position of said roof bolter after said single indexing thereof; and
- (c) means for positioning said roof bolter, first into said one and then into its said second position.

2. A roof bolter as claimed in Claim 1, wherein
15 said combined means includes a device having two converging passages: a drilling passage and a resin injection passage.

3. A roof bolter as claimed in Claim 2, wherein
20 said device comprises a housing block and at least one nozzle mounted on said block, said drilling passage being concentric with said nozzle, said resin injection passage connecting with said drilling passage at an angle and below said nozzle.

4. A roof bolter as claimed in Claim 3, wherein
25 said nozzle is provided with an inner bushing having an inside diameter somewhat larger than the inside diameter of said resin injection passage, and wherein said housing is formed with a tapped portion and said nozzle is formed with an externally threaded portion meshing with said
30 tapped portion, whereby said nozzle is removably mounted to said housing.

5. A roof bolter as claimed in Claim 2, 3 or 4, wherein said angle of connection between said converging passages is about 30°.

35 6. A roof bolter as claimed in Claim 3 or 4 or in Claim 5 as appendant to Claim 3 or 4, wherein said housing block is further provided with a vent radially communicating with said drilling passage at a point

1 below the confluence of said two converging passages.

2 7. A roof bolter as claimed in any one of Claims
3 to 6, wherein said resin injection passage is formed
4 with an internal shoulder to facilitate the attachment
5 thereto of a pneumatic hose to introduce a resin cartridge
6 into said resin injection passage.

7 8. A roof bolter as claimed in Claim 3 or in any
8 one of Claims 4 to 7 as appendant to Claim 3, wherein
9 said housing block is further provided with a protective
10 solid ring member concentrically surrounding said nozzle
11 and extending from said housing block beyond said nozzle.

12 9. A roof bolter as claimed in any one of the
13 preceding claims and further including a boom supporting
14 said roof bolter at one end and communicating with means
15 at its other end for providing remote control operation
16 to said roof bolter.

17 10. A roof bolter as claimed in Claim 9, wherein
18 said means providing remote control operation to said
19 roof bolter is automated.

20 11. A process for resin bolting a mine roof
21 comprising:

- 22 (a) positioning a turret into a drilling position
23 with respect to said mine roof;
- 24 (b) drilling a hole with said turret in said mine
25 roof;
- 26 (c) without re-positioning said turret, inserting
27 a resin cartridge with said turret into said
28 hole; and
- 29 (d) positioning said turret into a bolt inserting
30 position with respect to said hole and
31 inserting a bolt with said turret into said
32 hole.

33 12. A process as claimed in Claim 11, wherein said
34 process is a fluid actuated process.

35 13. A process as claimed in Claim 11 or 12, wherein
36 said process is remotely controlled.

37 14. A process as claimed in Claim 11, 12 or 13, wherein said
38 process is automated.

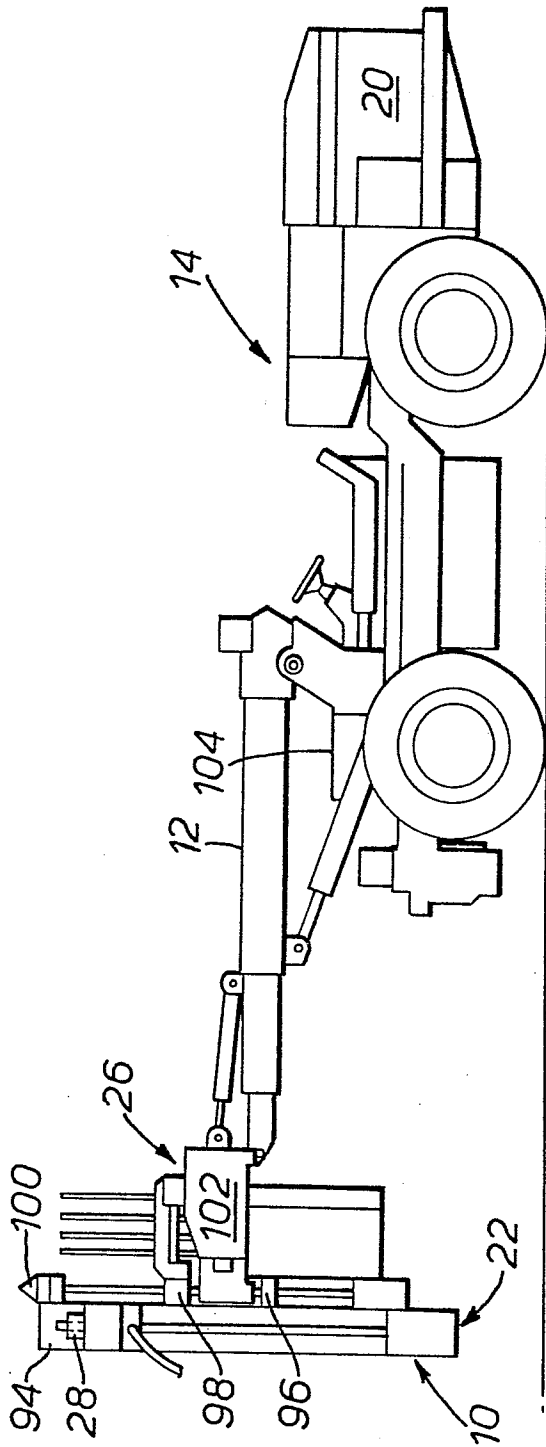


FIG. 1.

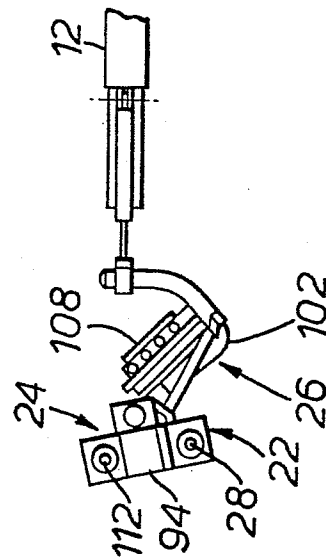


FIG. 2.

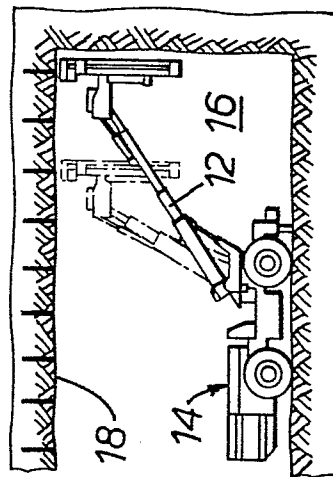


FIG. 3.

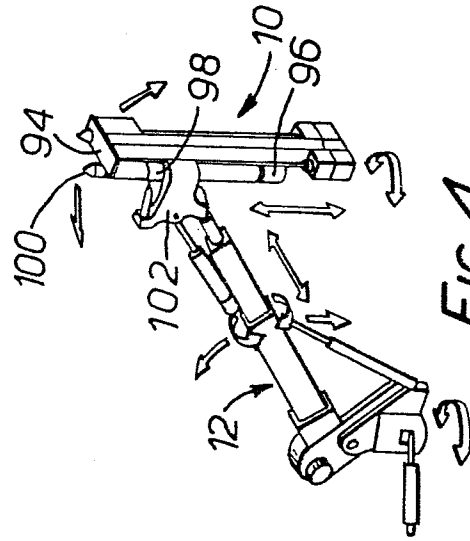


FIG. 4.

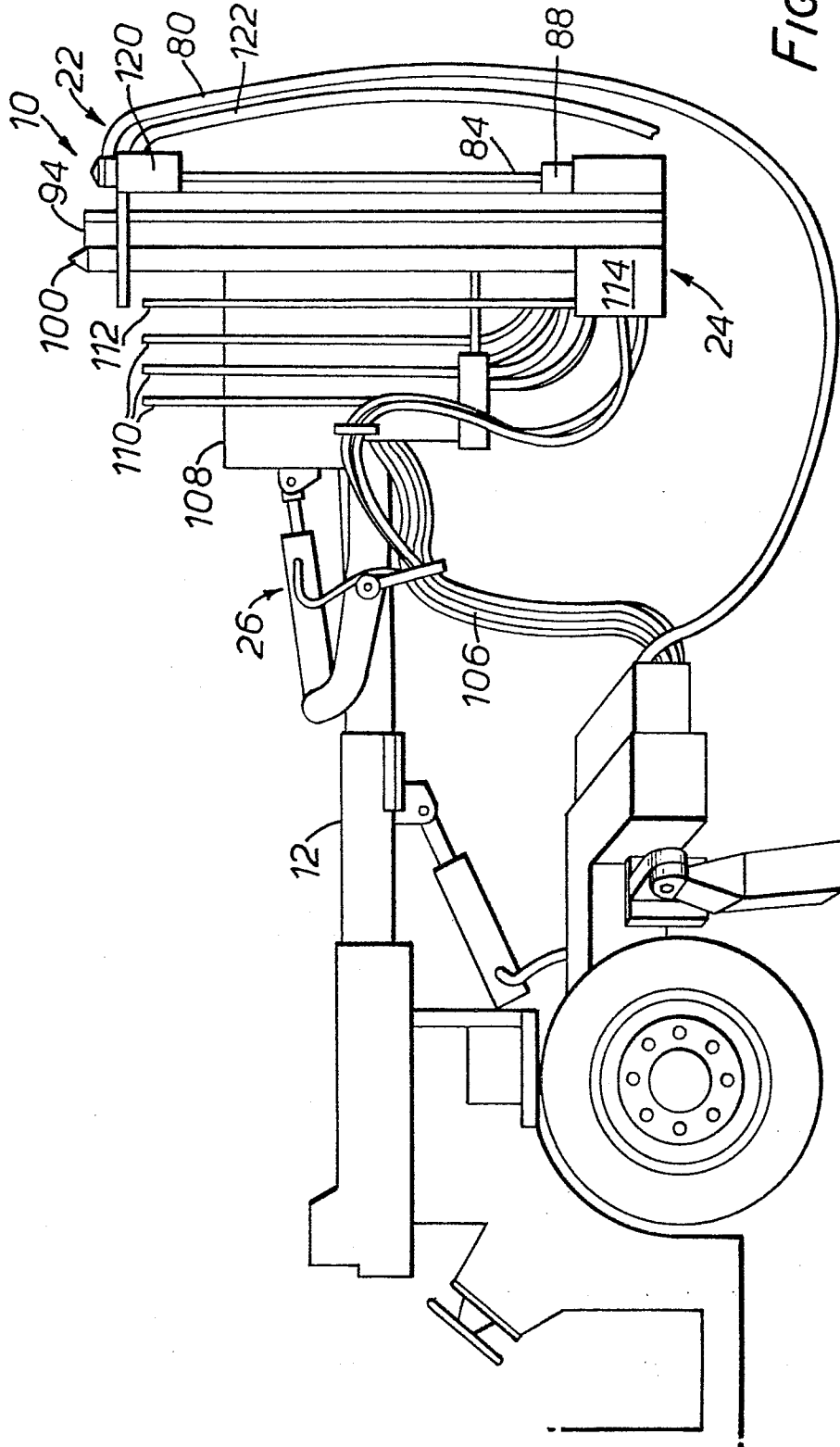


FIG. 5.

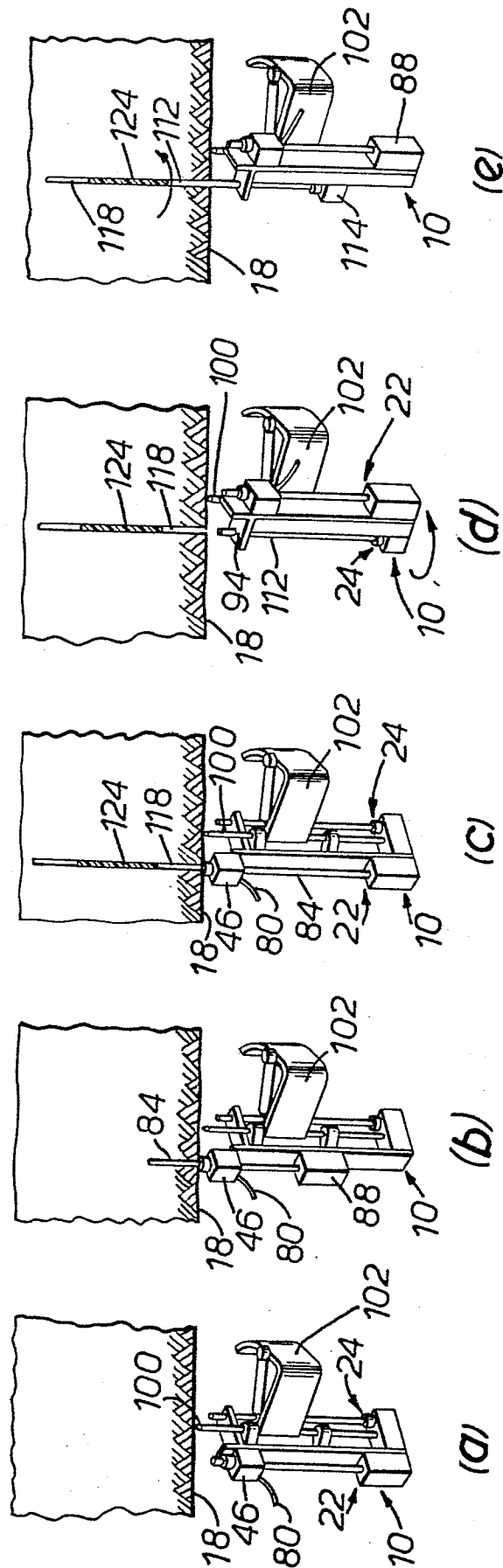
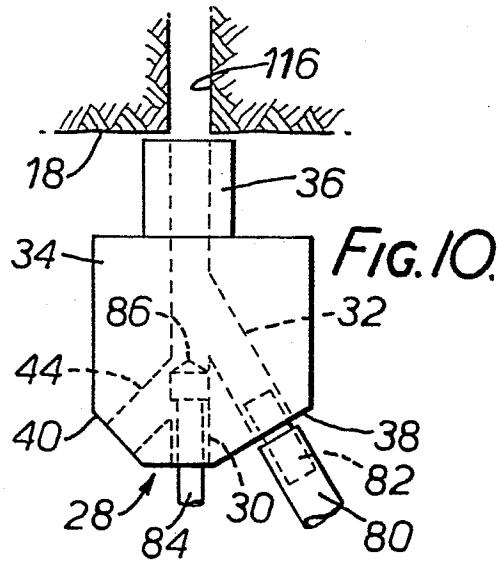
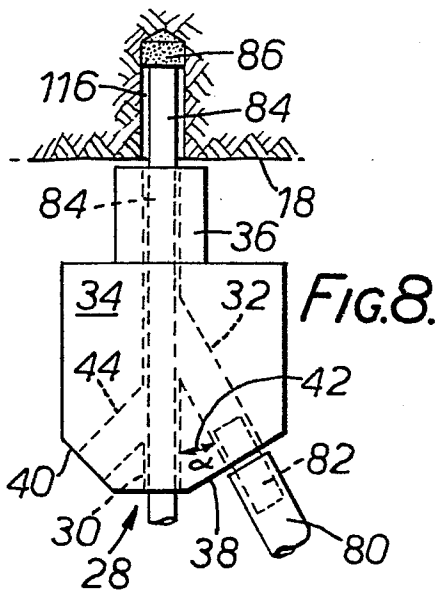
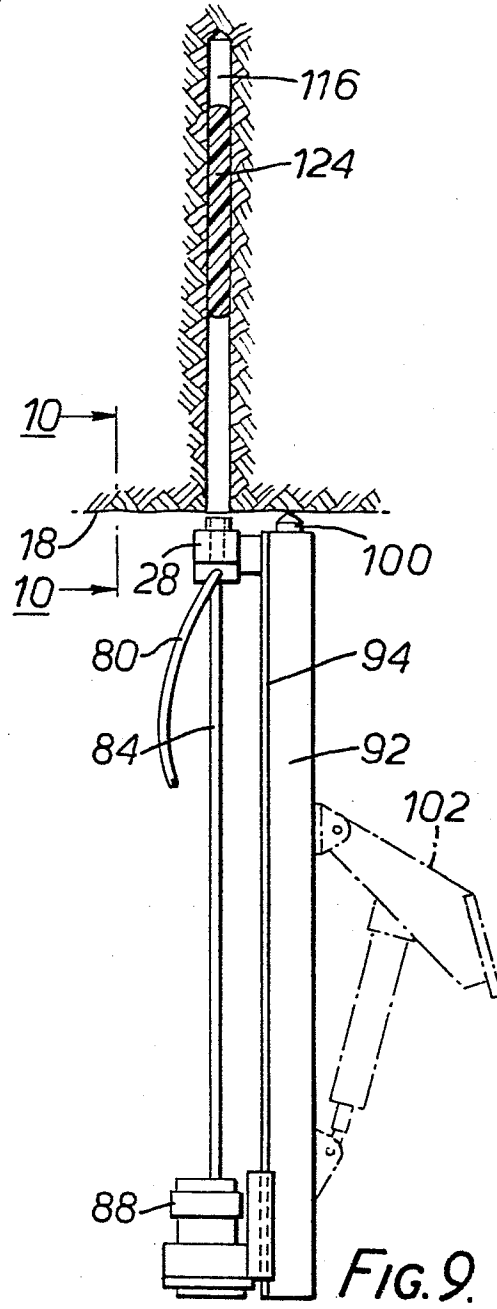
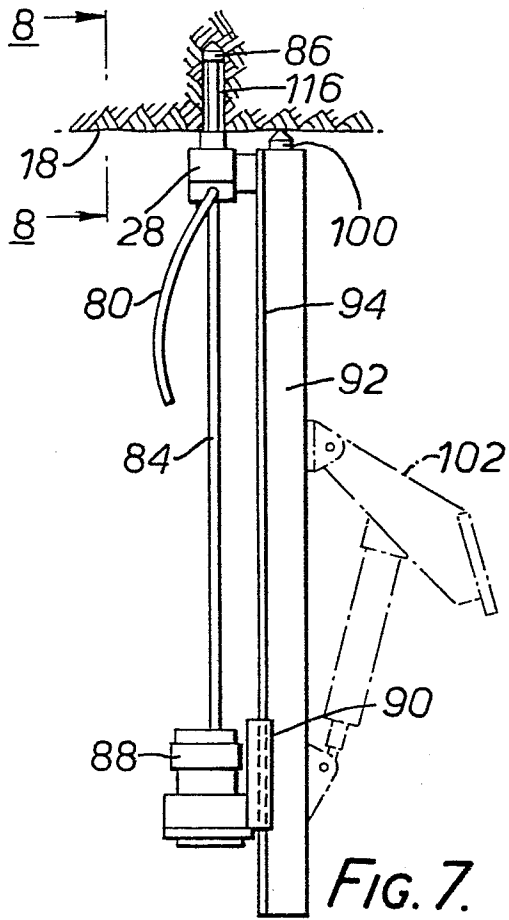


FIG. 6.



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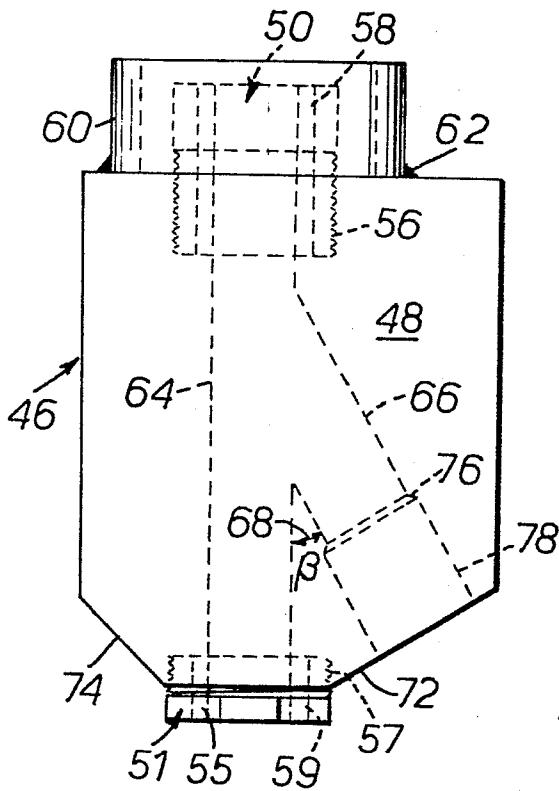


FIG. 11.

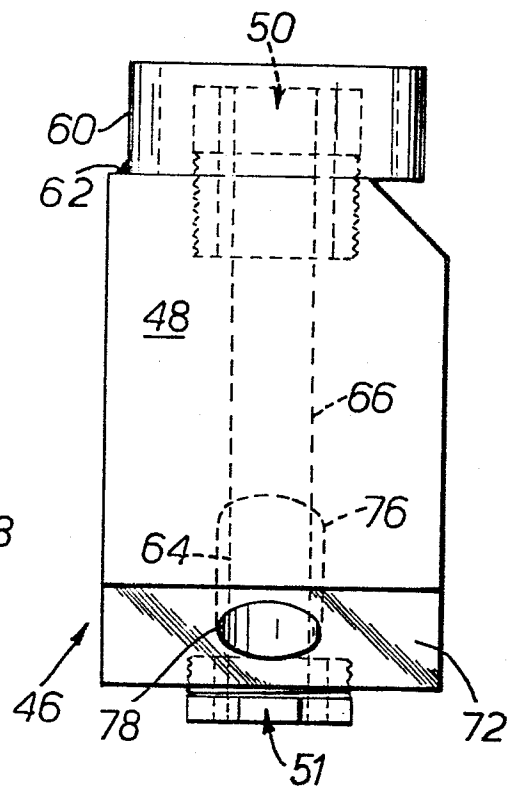


FIG. 12.

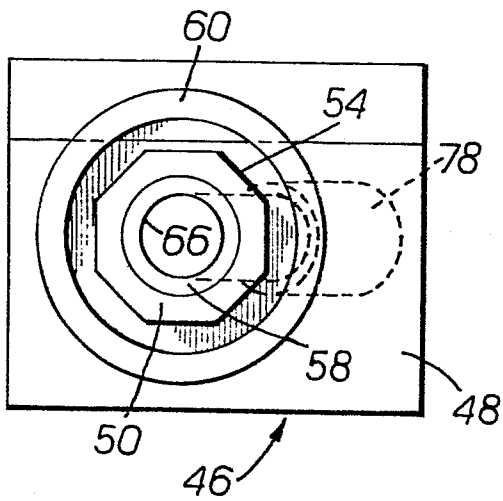


FIG. 13.

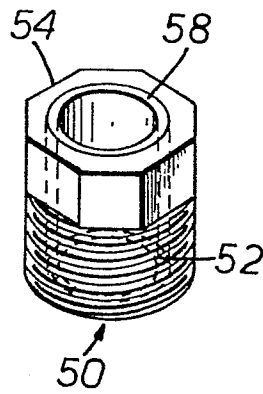


FIG. 14.

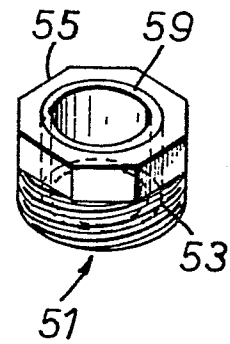


FIG. 15.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
A	GB-A-2 044 145 (S.E.C.O.M.A.)		
A	ER-A-2 337 250 (S.E.C.O.M.A.)		
A	US-A-4 165 690 (ABRAHAMS)		
A	US-A-4 040 329 (LJUNGBERG)		
A	FR-A- 884 628 (INGERSOLL-RAND)		
E	US-A-4 398 850 (TALVENSAARI) * Whole document *	1-14	TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-07-1984	Examiner HAKIN R.E.M.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			